

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 84305400.8

(51) Int. Cl.⁴: **H 01 R 43/048**
H 01 R 43/058

(22) Date of filing: 08.08.84

(30) Priority: 09.08.83 JP 123500/83 U

(43) Date of publication of application:
02.05.85 Bulletin 85/18

(84) Designated Contracting States:
DE FR GB

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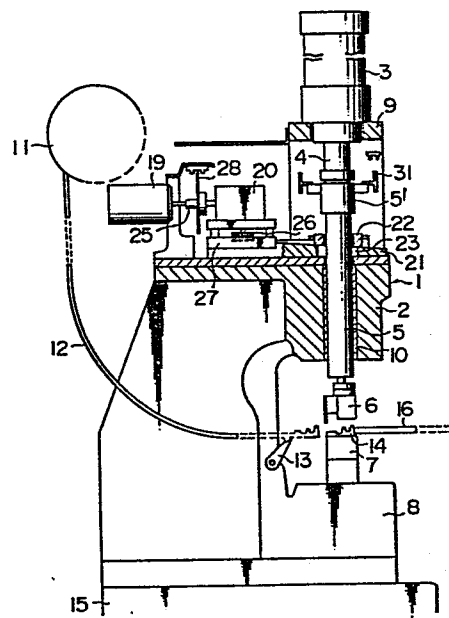
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(54) **Terminal crimping apparatus.**

(57) An apparatus for automatically crimping terminals (14) to electric wires (12) by a cooperation between a pressing punch (6) driven through a press ram (5) and a stationary anvil (7). The apparatus has a crimp height adjusting mechanism which includes a tapered spacer (21) movable perpendicularly to the press ram, a stopper member (22) having a complementary tapered surface and slidably placed on the tapered spacer so as to be able to move only vertically as the tapered spacer is moved. The stopper member (22) has an upper surface adapted to be contacted by a portion (5') of the press ram thereby determining the stroke end of the press ram (5). The tapered spacer (21) is slidably moved in a controlled manner by an electric motor (19), so that the heightwise position of the stopper member (22) is changed to allow a delicate adjustment of the lower stroke end of the

press ram (5). In consequence, the crimp height is automatically adjusted minutely in accordance with the diameter of the electric wire to be processed.

FIG. 1



TERMINAL CRIMPING APPARATUS

1 BACKGROUND OF THE INVENTION

The present invention relates to an improvement
in a terminal crimping apparatus for crimping terminals
automatically and consecutively to the ends of electric
5 wires.

A typical known terminal crimping apparatus has
a pressing punch attached to the lower end of a press ram
and an anvil disposed below the press ram. In operation,
electric wires and terminals are supplied consecutively
10 onto the anvil and the pressing punch is repeatedly driven
downwardly thereby to automatically and consecutively crimp
the terminals to the ends of the electric wires. This
known crimping apparatus, however, suffers from the follow-
ing disadvantage. In most cases, the diameter of the
15 electric wire, as well as the size and shape of the
terminal, varies depending on the uses, so that the crimp
height, i.e., the height of the terminal crimped on the
electric wire from the surface of the anvil, varies widely.
The known crimping apparatus of the type explained before,
20 however, is intended for the crimping of the terminals of
an equal size and shape to electric wires of a given
diameter. Namely, it is necessary to take trouble of
accurately measuring the final crimp height and precisely
adjusting the lower stroke end of the pressing punch, in
25 the preparatory step each time the diameter of the electric

1 wire is changed.

In consequence, the man-hour in the preparatory step is increased undesirably.

In the modern automatic system, a series of
5 operation including cutting of electric wire, stripping, twisting of the stripped conductor and crimping of a terminal, is conducted by a continuous line. Such an automatic system is often required to cope with a demand for a large-lot and small-quantity production. With the
10 known crimping apparatus of the type described, it is quite difficult to cope with such a demand.

SUMMARY OF THE INVENTION

Accordingly, we have now
devised a novel crimping apparatus which can crimp
15 terminals to electric wires in a good condition even if the crimp height is varied in successive crimping cycles.

To this end, according to the invention, there is provided a crimping apparatus for crimping a terminal to the end of an electric wire comprising: a press ram
20 provided at its lower end with a pressing die; an anvil disposed stationarily to oppose to the pressing die; means for successively supplying terminals onto the anvil; means for feeding electric wires into the terminal on the anvil; means for actuating the press ram against the anvil thereby
25 to crimp the terminal to the end of the electric wire; and crimp height adjusting means adapted to determine the crimping stroke end of the ram.

1 These and other objects, features and advantages
of the invention will become clear from the following
description of the preferred embodiments taken in
conjunction with the accompanying drawings.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevational view of an embodiment
of the terminal crimping apparatus in accordance with the
invention;

Fig. 2 is a front elevational view of the crimping
10 apparatus shown in Fig. 1; and

Fig. 3 is a perspective view of a crimp height
adjusting mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to Figs. 1 to 3, a terminal
15 crimping apparatus 1 of the invention has a frame 2
carrying a column 9 which in turn mounts a hydraulic
cylinder 3 directed downwardly. The hydraulic cylinder 3
has a rod 4 to which connected is a press ram 5. The
press ram 5 is adapted to be moved up and down along the
20 guide surface 10 on the frame 2. A pressing punch 6 which
is known per se is attached to the lower end of the press
ram 5. On the other hand, an anvil 7 which serves as a
lower die for cooperating with the pressing punch 6 is
mounted on a base 8 so as to oppose to the pressing punch
25 6. A terminal chain reel 11 having terminals connected in
the form of a chain or a belt is mounted on the rear upper

1 portion of the crimping apparatus. The terminals 14
connected in the form of a chain is fed onto the anvil 7
in a one-by-one fashion by a feeding claw 13 disposed at
one end of a terminal chain guide 12 connected to the
5 terminal chain reel 11. On the other hand, an electric
wire 16 to which the terminal 14 is to be crimped is
successively fed by a suitable feeding means. The feed of
the electric wire 16 is made in such a manner that the end
of the wire 16 is inserted into the terminal 14 on the
10 anvil. Then, the pressing punch 6 is lowered to press the
crimping portion of the terminal 14 thereby to crimp the
terminal 14 to the electric wire. This operation is
repeated to crimp the terminals 14 onto the ends of
electric wires 16 which are fed successively.

15 According to the invention, the terminal crimping
apparatus 1 is provided with a crimp height adjusting
mechanism which will be explained hereinbelow. Referring
to Figs. 1 and 3, the frame 2 carries a tapered spacer 21
perpendicular to the press ram 5 and adapted to move in the
20 back and forth direction, i.e., to the left and right as
viewed in Fig. 1. The tapered spacer 21 has a tapered
surface the height of which is progressively decreased from
the front to rear end thereof at a small gradient. The
aforementioned press ram 5 is received by a bore 23 formed
25 in the front half part of the tapered spacer 21. A stopper
member 22 is provided with a tapered back surface which is
tapered in the direction opposite to the tapered surface of
the tapered spacer 21 at the same gradient with the latter.

1 The stopper member 22 rests on the tapered surface of the tapered spacer 21 and is provided at its central portion with a hole for receiving the press ram 5. The arrangement is such that, when the press ram 5 is moved downwardly, the upper end of the stopper member 22 is contacted by the lower end of a boss 5' of the press ram 5, thus determining the lower stroke end of the press ram 5. It will be seen that the lower stroke end can be adjusted freely by sliding the tapered spacer 21 due to the mutual contact of the tapered surfaces of the stopper member 22 and the tapered spacer 21.

The sliding of the tapered spacer 21 is effected by the following arrangement. An electric motor 19 is carried by a bracket 24 provided on a rear upper portion of the frame 2. A speed reducer 20 mounted on the frame 2 is connected to the rotor shaft 25 of the electric motor 19. The speed reducer 20 is provided at its output side with a pinion 26 which engages with a rack 27 provided on a rear upper portion of the tapered spacer 21. Consequently, the tapered spacer 21 is slid back and forth in the direction of the arrow A as the electric motor 19 operates. In order to correctly control the sliding stroke of the tapered spacer 21, an A.C. motor or a servo motor is used as the electric motor 19, and an optical sensor 28 is attached to the rotor shaft 25 of the electric motor 19. Namely, the amount or stroke of the sliding movement of the tapered spacer 21 is controlled by a control circuit which is adapted to control the number of forward or backward

1 rotations of the rotor shaft 25 which is sensed in the form
of pulses counted by the sensor 28.

The sliding movement of the tapered spacer 21 is
smoothed by a pair of guide grooves 29 which slidingly
5 receive corresponding side edges of the tapered spacer 21.
The lateral movement of the stopper member 22 is prevented
by the members in which the guide grooves 29 are formed,
while the movement of the same in the back and forth
direction is prevented by holding frames 30 which bridge
10 the above-mentioned members. Thus, the stopper member 22
is allowed to move only in the vertical direction by the
wedging action of the tapered spacer 21. A reference
numeral 31 designates a sensor for confirming the upper
and lower stroke ends of the press ram 5.

15 The terminal crimping apparatus having the
described construction operates in a manner explained
hereinunder.

Namely, as an instruction representing a new
crimp height is given, the electric motor 19 operates to
20 drive the spacer 21 forwardly or backwardly so that the
stopper member 22 is moved upwardly or downwardly. The
vertical position of the stopper member 22 is thus adjusted
minutely. The stopper member 22 is contacted by the boss
portion 5' of the press ram 5 moving downwardly, thus
25 determining the downward stroke end of the press ram 5,
i.e., the distance H between the pressing punch 6' and the
anvil 7 as shown in Fig. 2. This crimp height is exactly
same as that instructed by the control circuit. Namely,

1 the amount of rotation of the rotor shaft 25 of the
electric motor 19, which determines the amount of the
sliding movement of the tapered spacer 21 and, hence, the
crimp height, is precisely controlled partly because the
5 amount of rotation is fed back by the sensor 28 which
detects the number of pulses corresponding to the rotation
amount of the rotor shaft 25 and partly because the
rotation amount is transmitted to the tapered spacer through
the intermediary of the speed reducer 20. In addition, the
10 reactional thrust produced by the impacting contact of the
press ram 5 with the stopper member 22 is safely born by
the speed reducer 20 so that the tapered spacer can be held
correctly at the aimed position. Furthermore, the vertical
height of the stopper member 22 can be adjusted minutely
15 thanks to the wedging action of the tapered spacer 21,
thereby permitting a delicate adjustment of the lower stroke
end of the press ram 5, i.e., the crimp height.

Date concerning the crimp heights for successive
electric wires having different diameters are inputted
20 beforehand in the control circuit, so that the slide of the
tapered spacer 21 is adjusted to provide the desired crimp
height for each crimping cycle. Consequently, the crimping
apparatus of the invention can be used conveniently in the
large-lot and small-quantity production of electric wires
25 having crimped terminals, not to mention to a mass
production of wires with crimped terminals having of the
same size and shape.

Although the invention has been described through

1 specific terms, it is to be noted here that the described
embodiment is not exclusive and various changes and
modifications may be imparted thereto without departing
from the scope of the invention which is limited solely
5 by the appended claims.

CLAIMS:

1. A crimping apparatus for crimping a terminal to the end of an electric wire comprising:

a press ram provided at its lower end with a pressing die;

an anvil disposed stationarily to oppose to said pressing die;

means for successively supplying terminals onto said anvil;

means for feeding electric wires into the terminal on said anvil;

means for actuating said press ram against said anvil thereby to crimp said terminal to the end of said electric wire; and

crimp height adjusting means adapted to determine the crimping stroke end of said ram.

2. A crimping apparatus according to claim 1, wherein said crimp height adjusting means has a tapered spacer disposed perpendicularly to said press ram and provided with a tapered upper surface, a stopper member having a tapered lower surface and having an upper surface adapted to be contacted by said press ram, and a driving means for slidably driving said tapered surface in the direction perpendicular to said press ram.

3. A crimping apparatus according to claim 2, wherein said driving means includes an electric motor and a speed reducer for transmitting the power of said electric motor to said tapered spacer.

4. A crimping apparatus according to claim 3, further comprising control means for controlling the operation of said electric motor and a feedback means for feeding back the amount of rotation of the motor shaft to said control means.

FIG. 1

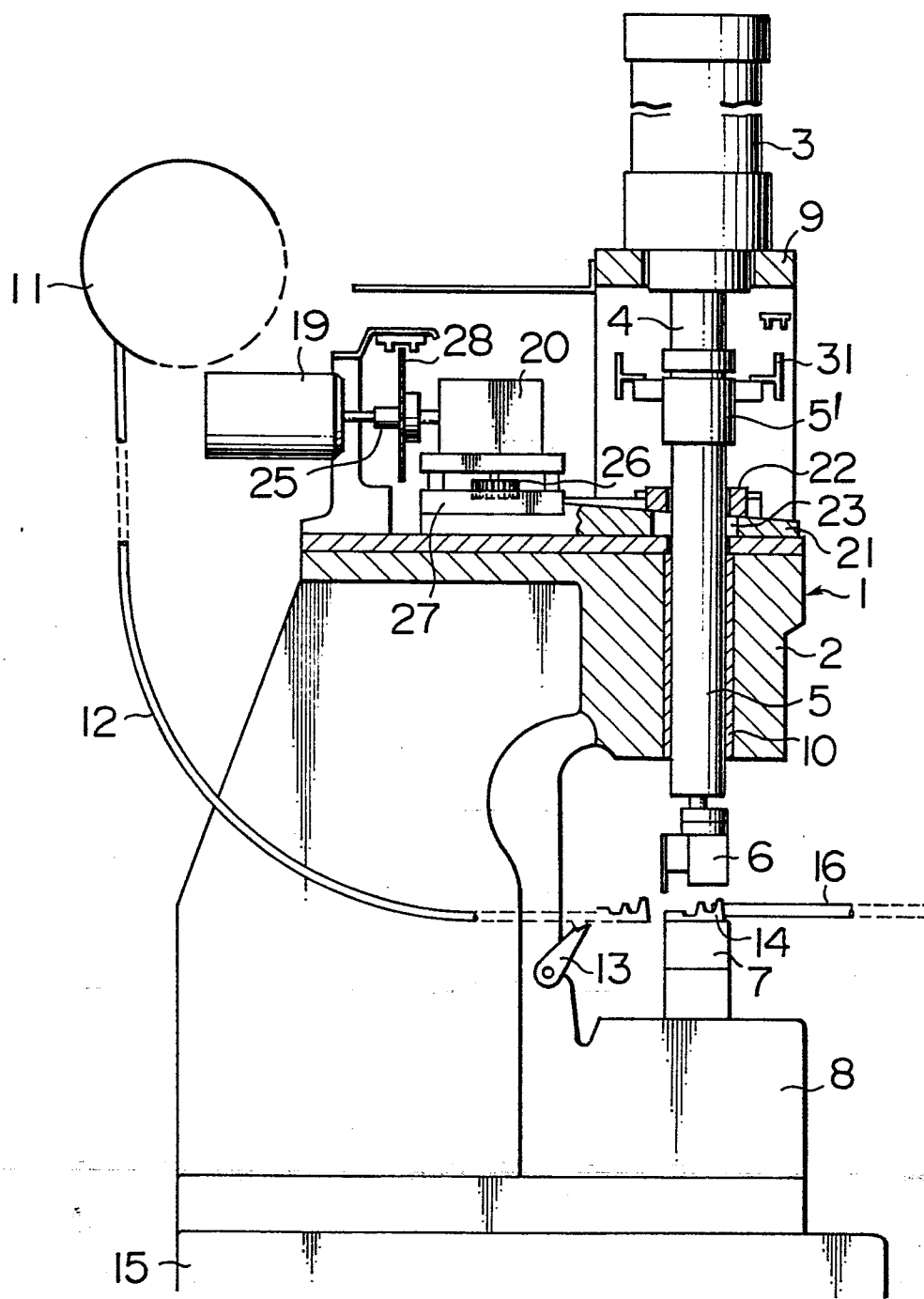


FIG. 2

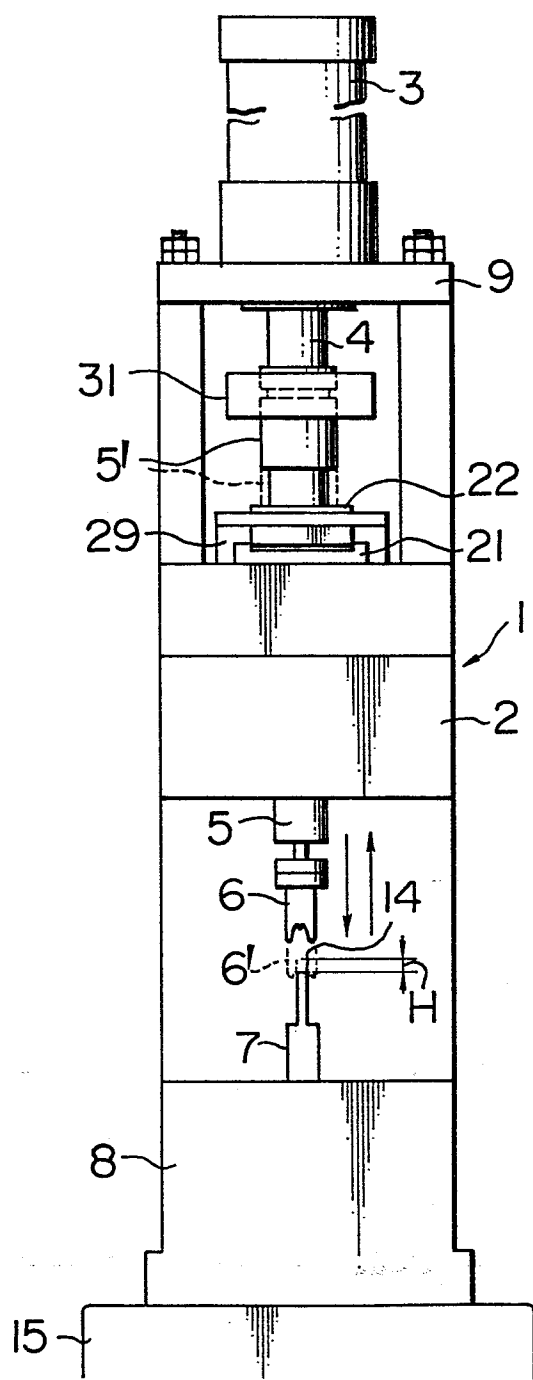
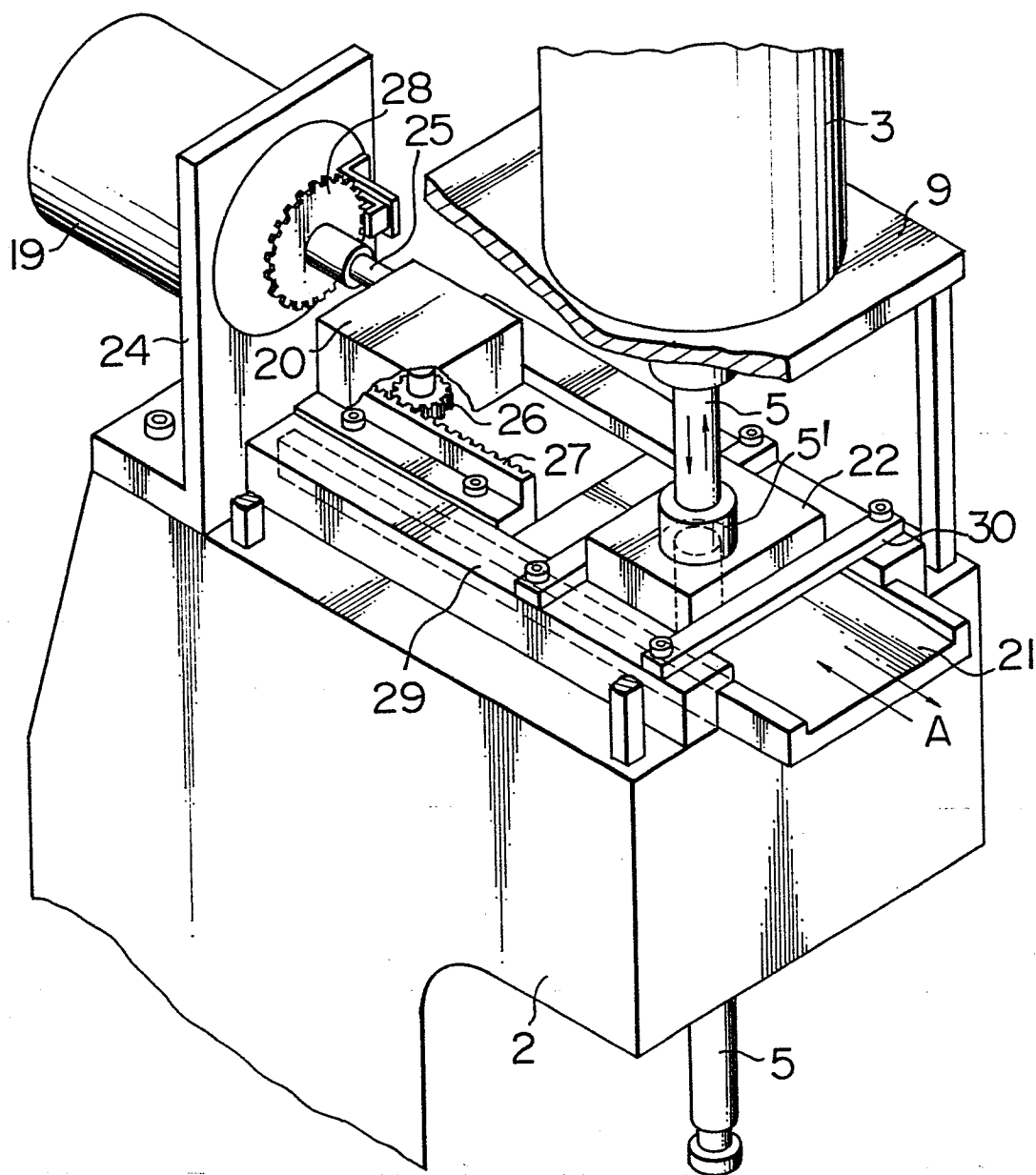


FIG. 3





European Patent
Office

EUROPEAN SEARCH REPORT

0139368
Application number

EP 84 30 5400

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-4 025 999 (WOLYN et al.) Column 3, lines 6-28; column 6, lines 26-55; figures 1-3 *	1	H 01 R 43/048 H 01 R 43/058
A	DE-A-2 501 192 (DEUTSCHE ITT) * Claims 1, 3; page 1, line 6 - page 3, line 25; page 5, line 3 - page 7, line 12; figures 1-13 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			H 01 R 43/04
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 06-11-1984	Examiner HAHN G
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	